

ART. VII.—*Note on the "Dimpling" of Granite Hills in Sub-Arid Western Australia.*

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(With Plate V., Figures 1, 2.)

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In the south-central sub-arid portion of Western Australia, a large number of low and comparatively small isolated hills of granite rise above the surrounding elevated plain or plateau, which forms so marked a feature in Western Australian physiography. These hills are usually almost, if not entirely, destitute of vegetation and of soil, and they are like minute scattered islands rising from the sea of ordinary vegetation-bearing country. They have played an important part in the exploration and opening-up of the interior of Western Australia; for it is at their feet, or on their sides that "soaks" or rock holes, carrying water, may be found. It is on such supplies that the aborigines largely depended, and they were a most valuable aid to the white man in penetrating to the arid interior of the continent.

These hills show the usual rounded flowing surface—due to spheroidal weathering—common to granite in many parts of the world; and also the boulders that result from such weathering. They, however, differ from the moister areas in the peculiar undermining and hollowing out from below upwards of many of the boulders, the result of which processes is to be seen in the grotesque forms often assumed by the granite.

In addition to these features, several hills that the writer has seen—and doubtless what is to be described is a common phenomenon—show, when examined in detail, a peculiarly irregular, although still rounded, outline. This feature is due to the occurrence of a number of shallow cavities or holes, and the general effect is a dimpled appearance of the surface. Hence the term "dimpling" may be used to indicate the process by which such cavities are formed. The "dimples" are circular, elliptical or oval in outline, are from two to three feet to ten feet or more in their longer diameters, and are from a few inches to three or four feet deep at their deepest part. Their walls

may be approximately uniform in height, but frequently, opposite walls taper to a low lip over which surplus water may pass. The “dimples” may be scattered irregularly over the surface of the hill, or they may be collected along somewhat definite lines, such as a drainage furrow incised by erosion in the side of the hill, in which latter instance they form a series of hollowed-out steps; or both classes may occur. Rain water remains in these shallow holes usually but a short time.

The granite hills known to the writer on which the characters described may be observed, are the 19 Mile Rocks situated about 17 miles east-north-east of Goongarrie railway station¹, and at the Donkey Rocks, about 18 miles farther east-north-east; also to a less extent at the 22 Mile and 25 Mile Rocks, to the east of the 19 Mile Rocks.

With regard to the mode of formation of these “dimples,” they are probably formed in much the same way as the more normal rock or “gnamma” holes, of which the “dimples” merely form a variety. The mode of formation of “gnamma” holes has been discussed by Maclaren, by Talbot and by Woodward. Maclaren² favours solution as the essential process, the narrow openings of some holes being due to a hard surface crust resisting erosion more than the rock below. Talbot³ believes that they may have originated either by the decay of a rock with more felspar than the adjacent rock, or by a shallow crack in the granite. Solution by water charged with carbonic acid would enlarge the incipient hole, and animals and aborigines would still further enlarge them by scratching the sides, and removing the weathered rock to obtain the last drop of water. Woodward’s ideas⁴ are practically the same as Talbot’s, except that he does not refer to the possibility of a crack or joint facilitating the commencement of a hole, although one of his figures shows the effect of a joint in the making of a hole. Woodward suggests that a beginning may be made by the more rapid weathering out by water of segregations in the form of pegmatitic bunches than of the containing rock. Animals then scratch out the remaining grit.

1. This railway station is on the Kalgoorlie-Leonora line, and is about 55 miles north of Kalgoorlie.

2. Maclaren, J. M.—*Geol. Mag.*, 1912, pp. 301-304.

3. Talbot, H. W. B.—*Bull.* 45, *Geol. Surv., W.A.* (1912), pp. 38, 39.

4. Woodward, H. P.—*Bull.* 57, *Geol. Surv. W.A.* (1914), pp. 33-35.

The present writer does not at present desire to discuss the mode of origin further than to state that he agrees with the authors just mentioned as to the commencement of the hole being in some instances due to more easily eroded portions of the rock surface, than other portions, and also as to the effect of joints and of solution in the formation of various gnamma holes. With regard, however, to the "dimples" the subject of this paper, joints, so far as the writer has observed, have had little or no influence in the excavations. Solution on the other hand has undoubtedly played an important part. In the case of "dimples" formed along a drainage furrow on the side of a hill, the mechanical action of water, when the holes overflow after heavy rain, and the water passes from one hole to another by a series of low waterfalls, must, to some extent, be responsible for the erosion.

DESCRIPTION OF PLATE V., Figures 1, 2.

- Fig. 1.—A series of "dimples" in an erosion furrow on a side of the granite hill. The furrow commences at the top towards the right hand side, and runs to the centre of the photograph. 19 Mile Rocks.
- Fig. 2.—An individual "dimple" or rock hole on a side of the hill. A channel is being cut backwards towards the lip of the hole owing to the overflow at the lip. The hole is empty, but the height that the water reaches is clearly shown on the photograph. 19 Mile Rocks.